7. Contributions to the Non-Marine Fauna of Spitsbergen.—Part II. Report on the Rotifera. By David Bryce.[1]

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The material received for examination was contained in 13 tins, and when handed to me had already been encased for some months, yet without much prejudice to the vitality of the various micro-organisms hidden within it. It consisted of Mosses, apparently of such species as usually grow in wet places (for species see *ante*, p. 785), and was still abundantly moist. In many cases, however, the moss-plants were so encumbered with soil and decayed fragments of preceding generations as to render their examination for the purpose in view an exceedingly difficult and a lengthy matter. Repeated attempts were made to ascertain the presence of Rotifera in the contents of each tin, with the result that 5 tins were found to contain from 4 to 15 species each, 2 tins one or two individuals only, and 6 tins none at all. In every case the dirt-laden material was quite unproductive, and some of the cleaner mosses were equally disappointing, whilst in none were the individuals more than moderately numerous.

As was to be expected from mosses, the Bdelloid Rotifera were by far the most numerous, both as to number of species represented and as to number of individuals seen. Among the Bdelloida, again, the genus *Callidina* was prominent, claiming no less than 13 of the whole 26 species on the list. But besides these 13 species, which were capable of recognition, I found various isolated examples which I could not with any satisfaction refer to any species described or even known to me, and it is likely that if examples had been more numerous I should have been justified in giving specific names to these forms. All the 26 species have been already met with either in England or in Germany, and it would seem that, so far as regards the actual species of moss-dwelling Rotifera, there is little to distinguish the fauna of Spitsbergen from that of these countries.

The interest of the list is, however, less in the number of species enumerated than in the evidence afforded of the vitality and endurance of these minute yet highly organized animals under such exceedingly trying conditions of life as those obtaining on the island of Spitsbergen. For under the most favourable conditions none of these creatures can have there a continuously active existence of more than three months. In more temperate countries the moss-dwelling Rotifera are called upon to endure recurring periods of temporary drought, but such periods occur rarely except in summer, and are even then mitigated by nightly dews or occasional rainfall. For the greater part of the year, autumn, winter and spring, there is moisture sufficient for their wants, and, so long as the temperature does not fall below freezing-point, life goes on merrily and generation succeeds generation, whilst periods

[1] Communicated by Dr. J. W. Gregory, F.Z.S.

of cold, when the moss is frost-bound, are rarely of long duration. In the far north latitude of Spitsbergen, *circa* 78°, the frozen state is the rule, the moist the brief exception, and an individual *Callidina* (whose average existence may be reckoned as comprising at least some three months of active life) may quite possibly live during several summers, expending its three months in annual instalments. This capacity for the endurance of long periods of cold was already known from Ehrenberg's (4) discovery of certain forms on the Swiss Alps at a great elevation. The few species noted by him all belong to the Bdelloida, so that whilst the present list widens the record as regards that group, it extends it to at least 7 species of the Ploïma.

There appear to be but two previous records of Rotifera at so high a latitude.

In 1862 A. von Goes recorded two species of *Callidina*, which he had found in some moss; the species were not, however, determined ("Om Tardigrader, Anguillulæ m.m. från Spetsbergen," Öfvers. K. Vet.-Akad. Förh. 1862, p. 18).

In 1869 Ehrenberg (5) had brought to him some material which had been collected in Spitsbergen in 1867. This material included some mosses, and in these he found one Rotifer, *Callidina alpium*, and an "egg of a Rotifer" unknown, among several forms belonging to other orders. This statement occurs in a Report upon the results afforded by material collected by the Second German North Polar Expedition of 1869 and 1870.

For the rather lower latitudes of Greenland, several lists have already been published, the most important being contained in the treatise by Bergendal (1), in which are enumerated and discussed some 82 species collected by the author at various localities between the parallels of 66° and 70° N. during the summer of 1890. At first sight it appears curious that, with but three exceptions, none of the forms found by him in Greenland have occurred in the Spitsbergen material. Bergendal, however, devoted his attention chiefly to the ordinary water-dwelling Rotifera, and seems to have rarely examined mosses. Nor does he seem to have been cognisant of the fact that moss-dwelling Rotifera can be secured and studied at leisure months after collection, as was done by Ehrenberg and as has been done in the present case. There is therefore no real ground for comparison between his list and that hereto appended. It may be mentioned that, of the eleven species of the Bdelloida included by him, one only has been found in the course of this investigation.

Notwithstanding their Arctic nativity, many of the species were kept alive for weeks in small cells, whilst others seem at this date (April 1897) to have permanently established themselves in a jar of water, into which I have from time to time thrown moss which I had washed, as well as washings after final examination.

The majority of the species have already been sufficiently described, and in these cases I have merely indicated their comparative abundance in the five tins which yielded positive results.

Some few remarks are added on the most interesting details relative to the rarer forms, whilst brief descriptions are furnished for one species, not hitherto described, but which I had previously seen in England, and for one other which it has been necessary to rename.

Order BDELLOIDA.

1. Philodina erythrophthalma, Ehr.

It is with some little doubt that I refer to this species a form which is very closely related to *Philodina citrina*, and differs from it principally in the size of the mastax (rami, 0·022 mm. long) and in the shape of the egg (oval, symmetrical and smooth). The species is included in Bergendal's list, but it is impossible to affirm that the form seen by him is identical with that now found, for, although described by Ehrenberg as the commonest of the genus, the species is at the best an unsatisfactory one, the original description being exceedingly meagre. Gosse has given fuller details of a form which he thought he could refer to it, but these have not been found useful to establish the identity even of the subject of his description. The species has been noted again and again in local lists, but never with any attempt at better definition of its identity. On the other hand, Janson (6), when he wrote his paper on the *Philodinæa*, had failed to discover any form which he could assign to it, and he rejected it as invalid, and hitherto neither I nor several experienced correspondents have been more successful.

It would however appear, from the very meagreness of Ehrenberg's description, that the species should be closely related either to *P. citrina* or to *P. roscola*, and this postulate is fulfilled by the Spitsbergen examples, which when adult might easily be passed over as *P. citrina*, varying from the type in lacking the distinctive colour of that species. Closer examination, however, reveals several structural differences (minute, but constant in many examples), of which those mentioned above are themselves sufficient to establish specific rank. In young examples the corona is barely wider than the collar, and has a rather smothered appearance, which disappears as the animal approaches maturity. In habits it resembles *P. roscola*, being decidedly restless, and even when feeding it is incessantly changing its position. From its behaviour in the trough I judge it to be a "bottom-feeder," and to prefer feeding from a swinging base (as from a mucus thread) rather than from a firm one.

2. Philodina sp.

Some specimens with very coarse skin with prominent skin-folds, whose ridges were broken and wrinkled, were referred to a form recently discovered by Forstmeister L. Bilfinger of Stuttgart, and to be described in a paper now in preparation.

3. Rotifer tardus, Ehr.

A single specimen.

4. Callidina alpium, Ehr.

Ehrenberg's solitary species from Spitsbergen, previously found by him on the Swiss Alps. This confirms my identification with his species of the form found by me on the South Coast of England.

Two or three specimens only.

5. Callidina constricta, Duj.

In moderate numbers.

6. Callidina tetraodon, Ehr.

A few specimens.

7. Callidina musculosa, Milne.

A very few examples.

8. Callidina venusta, n. sp.

(=*Macrotrachela elegans*, Milne (7).)

(Inasmuch as the genus *Macrotrachela*, proposed by Milne, has fallen to the ground, the various species described by him have to be redistributed. *M. elegans* would thus become *Callidina elegans*, but that name had already been employed by Ehrenberg for a very different form. I take this opportunity of renaming a well-marked species, which, from the unfortunate choice of specific name, has lately been overlooked.)

Sp. Ch.—Rather slender, of medium length: corona very narrow (0·030 mm.), about equal to collar, a fourth wider than neck (0·023 mm.); disks separated by deep notch. Upper lip slightly convex. Dorsal antenna equal to or exceeding neck thickness. Head, neck, and trunk rather parallel-sided in dorsal view. Foot very short, of four joints rapidly tapering; spurs partly hidden, two short acute cones, held nearly parallel. Mastax scutelliform. Rami (0·016 mm.) long, formula 6/6 to 10/10. Food moulded into pellets. Maximum length 0·250 mm.

The present specimens vary from the type in having only about 6 teeth on each ramus, a variety already noticed in the London district. This species is rarely found in moss growing in positions usually dry. I have elsewhere noted its *quasi*-tube-making habits (2).

9. Callidina russeola, Zelinka.

This bulky species was present in some numbers.

10. Callidina lata, Bryce.

Two specimens occurred in one washing.

11. Callidina aspera, Bryce.

One living and one dead example.

12. Callidina plicata, Bryce.

The most numerous species.

13. Callidina pusilla, Bryce.

Some individuals with a very large jelly-like case, mostly whitish but sometimes tinged with brown, seemed structurally to be inseparable from the above species, the type form of which, as repeatedly found in England, constructs a very small and meagre tube. My correspondent Forstmeister L. Bilfinger mentioned to me some years back that he had found a variety with a large case and had provisionally named it "*textrix*," a name which may well be adopted for it as rather more than usually appropriate.

The case was flask-shaped, sometimes flattened on the ventral side, nearly twice as long as the feeding rotifer, and swelling up above and behind the trunk. The young individual will sometimes settle down on the side of another case, and thus several may come to form a single mass.

14. Callidina cornigera, Bryce.

Many species of *Callidina* so closely resemble each other in the normal or extended position, that it is necessary for identification to isolate every doubtful specimen and wait until it is sufficiently re-assured to feed whilst under observation, for it is only in the feeding position that the most distinctive features of such forms can be seen. Many, and especially the rarer forms, are exceedingly timid, and with such it is commonly useless to look at them again for several hours after isolation. One such doubtful specimen had been thus set aside for a week before I saw it feeding, when it showed itself to belong to this very abnormal species, which I originally described from a single specimen found at Bognor in Sussex. Some years later a second specimen was met with in moss collected in Buckinghamshire. The present is the third specimen found, and proves that the species, if rare, is at all events widely distributed. The creature lodged itself among débris and squatted in a most irregular manner, so that no sketch could be obtained. The figure already published gives a fair idea of the distinctive 'horns,' a structural peculiarity not approached by any other species yet known.

When extended, this specimen measured 0·347 mm., and the mastax formula was 2/2. I again found the rostral lamellæ unusually large and conspicuous.

15. Callidina papillosa, Thompson.

Some half dozen examples.

16. Callidina habita, Bryce.

Three specimens.

17. Adineta vaga, Davis.

A few examples of the form I (3) have named var. *minor*, having the face narrower than long. This form, which in my experience is the more common, is, I understand from Mr. Davis, the type as known to him. The var. *major* was not represented.

18. Adineta barbata, Janson.

This well-marked species was seen several times.

19. Adineta gracilis, Janson.

Two or three small and slender examples seemed to belong to this species, but the form is difficult to distinguish from young specimens of *A. vaga* var. *minor*, unless a very good definition of the rostrum can be obtained.

Order PLOÏMA.

I. Illoricata.

20. Proales decipiens, Ehr.

Two or three examples only.

21. Furcularia gracilis, Ehr.

One specimen.

22. Diglena permollis, Gosse.

This species occurs rather frequently in mosses and even in such as grow in positions usually dry. It would thus seem to be able. like so many of the Bdelloida, to protect itself against the fatal lack of moisture. For although some writers have loosely ascribed this protective faculty to the Rotifera in general, I believe it to be in the main confined to the Bdelloida, and even there not universal. In the mosses now examined this species was not infrequent.

II. Loricata.

23. Stephanops stylatus, Milne (7).

A few examples enabled me to verify the general accuracy of Milne's description, and particularly of the mastax as figured by him.

24. Stephanops tenellus, n. sp.

Sp. Ch. Lorica delicate, yielding, laterally overlapping the very slender body ; posteriorly broadly and roundly truncate ; head-plate prominent, subsquare, decurved. Face prone, with several uncinate and one pair (at least) of long straight styles. Mastax twice as long as broad. Foot slender, retractile ; toes two, nearly parallel, decurved, about $\frac{1}{3}$ of foot. Maximum length about 0·080 mm. or barely $\frac{1}{300}$ inch.

One of the very smallest Rotifera known and of exceedingly delicate structure. In general form, if not in size, in structural details, in habit of life, and in its most characteristic movements, it is almost the counterpart of *S. stylatus*, and indeed when I first met with it in 1891 in company with *Distyla agilis* I took it to be simply the very young form of its congener, which when adult is fully twice as long. In the present instance I had isolated a specimen to make certain that it was not *D. agilis*, when it almost

immediately extruded an egg; and this first led me to suspect that the form was not an immature *S. stylatus*, but the adult of a distinct species. On closer examination the mastax was distinctly seen to be twice as long as broad, whereas in the larger species it it rather broader than long.

Whilst under the one-inch power the fleshy parts alone are visible, and the animal appears to be extremely slender with an almost pointed head; and it is only when high powers are brought to bear upon it, that its full resemblance to *S. stylatus* can be appreciated. The lorica proves to be proportionately as ample as in that species, and of much the same outline, but is more deflexed to cover the sides. It is exceedingly delicate and yields to every movement. In the trough the animal is only to be detected by its vivacity; when still, it is scarcely to be distinguished even when its position is known. It runs along very quickly with a series of dashes, and if alarmed, either remains motionless or throws itself into the most violent contortions.

Of this interesting form I saw some 15 to 20 examples, but they were exceedingly difficult to catch, and as difficult to deal with after isolation. I quite failed to get any sketch, but the particulars given above are amply sufficient for its identification.

25. Colurus caudatus, Ehr.

A few examples seemed to agree best with Gosse's particulars of this species.

26. Metopidia lepadella, Ehr.

Two examples.

The following works are specially referred to by figures after names of authors.

1. Bergendal, D.—"Zur Rotatorienfauna Grönlands." Kongl. Fysiografiska Sälskapets Handlingar. Ny Följd 1891–2, iii. Sep. ed., Lund, 1892.
2. Bryce, David.—"On the Macrotrachelous Callidinæ." Journ. Quekett Micr. Club, v. (1892) p. 15.
3. Bryce, David.—"On the Adinetadæ." Journ. Quek. Micr. Club, v. (1893) p. 146.
4. Ehrenberg, C. G.—"Das organische kleinste Leben über dem ewigen Schnee der höchsten Centralalpen." Monatsberichte der Berl. Akad. der Wiss. p. 314 (1853).
5. Ehrenberg, C. G.—Das unsichtbar wirkende Leben der Nordpolarzone: Die Zweite Deutsche Nordpolarfahrt in den Jahren 1869 und 1870. Band ii. Leipzig, 1874.
6. Janson, Otto.—"Versuch einer Uebersicht über die Rotatorienfamilie der Philodinaeen." Beilage zum XII. Bande der Abhandl. des Naturwiss. Vereins zu Bremen, 1893.
7. Milne, W.—"On the Defectiveness of the Eyespot as a means of generic distinction in the Philodinæa." Proc. Phil. Soc. Glasgow, 1886.